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Measuring the Charge of the Neutron using a Time-Of-Flight Neutron Grating Interferometer

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The present best direct limit on the neutron electric charge is $(-0.4 + -1.1)10^{-}21$ e and was measured in a precision experiment by Baumann and colleagues in the 1980's [1]. In Bern we are pursuing the QNeutron project which investigates an innovative technique to measure ultra-small angle neutron beam deflections. The experimental apparatus consists of a symmetric Talbot-Lau type neutron interferometer with three absorption gratings operated in time-of-flight mode. Ultimately, the instrument shall allow to detect neutron beam deflections, e.g. due to an applied electric field, on the picometer scale. A full-scale experiment could lead to a statistical improvement of the neutron electric charge sensitivity by up to two orders of magnitude [2]. So far, several successful measurements have been performed with a prototype setup where deflections on the nanometer scale could be resolved. In this talk, we will present the fundamental idea, first results and challenges of this endeavor.

References
(1)Baumann, Gähler, Kalus, and Mampe, Phys. Rev. D 37, 3107 (1988).
(2)Piegsa, Phys. Rev. C 98, 045503 (2018).

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